

WHAT IS CLAIMED IS:

- 1           1.       A nanowire switching device comprising:  
2               a nanowire structure comprising an elongated member having a cross-sectional  
3       diameter ranging from about 1 nanometers but less than about 300 nanometers;  
4               a first terminal coupled to a first portion of the nanowire structure;  
5               a second terminal coupled to a second portion of the nanowire structure, the  
6       second portion of the nanowire structure being disposed spatially from the first portion of the  
7       nanowire structure; and  
8               an active surface structure coupled to the nanowire structure, the active surface  
9       structure extending from the first portion to the second portion along the elongated member,  
10       whereupon the nanowire structure has a first electrical value as measured between the first  
11       terminal and the second terminal while the active surface is subjected to a first environment, the  
12       nanowire structure having a second electrical value as measured between the first terminal and  
13       the second terminal while the active surface is subjected to a second environment, the second  
14       environment being different from the first environment.
- 1           2.       The device of claim 1 wherein the device is a switch, a sensor, a chemical  
2       sensor, photo-detector, an opto-electronic device, MEMS, MEOMS, and \_\_\_\_\_.
- 1           3.       The device of claim 1 wherein the device is a humidity sensor or an  
2       oxygen sensor.
- 1           4.       The device of claim 1 wherein the nanowire structure is characterized by a  
2       shape of a nanowire.
- 1           5.       The device of claim 1 wherein the active surface is about 10% to 90% of a  
2       total surface area of the nanowire structure.
- 1           6.       The device of claim 1 wherein the cross-sectional diameter ranges from  
2       about 1 nm to 500 nm.
- 1           7.       The device of claim 1 wherein the nanowire structure has an aspect ratio  
2       (length to diameter) of 10 to 1000.

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- 1                    8.        The device of claim 1 wherein the nanowire is made of a material that  
2        substantially single crystal.
  
- 1                    9.        The device of claim 1 wherein the nanowire is made of a material that is  
2        polycrystalline.
  
- 1                    10.      The device of claim 1 wherein the nanowire structure is made of a  
2        material that is a semiconductor.
  
- 1                    11.      The device of claim 10 wherein the semiconductor material is ZnO, SiGe,  
2        Si, Ge, SnO<sub>2</sub>, GaN, PbSe, PbS, or Bi<sub>2</sub>Te<sub>3</sub>.
  
- 1                    12.      The device of claim 1 wherein nanowire structure comprises at least a first  
2        material and a second material that are spatially separated from each other.
  
- 1                    13.      The device of claim 1 wherein the nanowire structure is made of a  
2        homogeneous material.
  
- 1                    14.      The device of claim 1 wherein the nanowire is heterogeneous in texture.
  
- 1                    15.      The device of claim 1 wherein the second environment comprises an  
2        intensity level, the intensity level being proportional to the second electrical value, the second  
3        electrical value comprising an electrical current and the second environment comprising electro-  
4        magnetic radiation.
  
- 1                    16.      The device of claim 1 wherein the device is operable at room temperature.
  
- 1                    17.      The device of claim 1 wherein the device is substantially free from high  
2        temperature thermal elements.
  
- 1                    18.      The device of claim 1 wherein the device is operable at 0 to 100 Degrees  
2        Celsius.
  
- 1                    19.      A method for switching an opto-electronic device, the method comprising:

2 providing a nanowire structure having a surface region, the surface region having  
3 a first chemical species attached to the surface region of the nanowire structure, the nanowire  
4 structure having the first chemical species providing a first electrical state of the nanowire  
5 structure; and

6 illuminating energy onto the surface area of the nanowire structure to change the  
7 nanowire structure having the first chemical species from the first electrical state to a second  
8 electrical state whereupon the second electrical state allows a conduction characteristic of the  
9 nanowire to change from the first electrical state to the second electrical state.

1 20. The method of claim 19 wherein the illuminating releases a portion of the  
2 first chemical species from the surface area of the nanowire structure.

1 21. The method of claim 19 wherein the illuminating converts the first  
2 chemical species into the second chemical species.

1 22. The method of claim 19 wherein the first chemical species can be selected  
2 from oxygen, NO<sub>2</sub>, H<sub>2</sub>O, NO, or SO<sub>2</sub>.

1 23. The method of claim 19 wherein the energy is electro-magnetic radiation.

1 24. The method of claim 19 wherein the nanowire structure is made of a  
2 semiconductor material.

1 25. The method of claim 24 wherein the semiconductor material is selected  
2 from is ZnO, SiGe, Si, Ge, SnO<sub>2</sub>, TiO<sub>2</sub>, or GaN.

1 26. The method of claim 19 wherein the nanowire structure is single  
2 crystalline or polycrystalline.

1 27. A nanowire opto-electronic switching device comprising:  
2 a nanowire structure comprising an elongated member having a cross-sectional  
3 diameter ranging from about 1 nanometers but less than about 300 nanometers;  
4 a first terminal coupled to a first portion of the nanowire structure;

5           a second terminal coupled to a second portion of the nanowire structure, the  
6 second portion of the nanowire structure being disposed spatially from the first portion of the  
7 nanowire structure; and  
8           an active surface structure coupled to the nanowire structure, the active surface  
9 structure extending from the first portion to the second portion along the elongated member,  
10 whereupon the nanowire structure has a first resistance value as measured between the first  
11 terminal and the second terminal while the active surface is subjected to a first level of electro-  
12 magnetic radiation, the nanowire structure having a second resistance value as measured between  
13 the first terminal and the second terminal while the active surface is subjected to a second level  
14 of electro-magnetic radiation.

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